Bell Work
23-Nov-2014

How many valence electrons do magnesium and oxygen have?

~~Draw their Lewis dot structures.~~

What do you think their chemical formula would be if they combine?

Bell Work
24-Nov-2014

What is an ion?

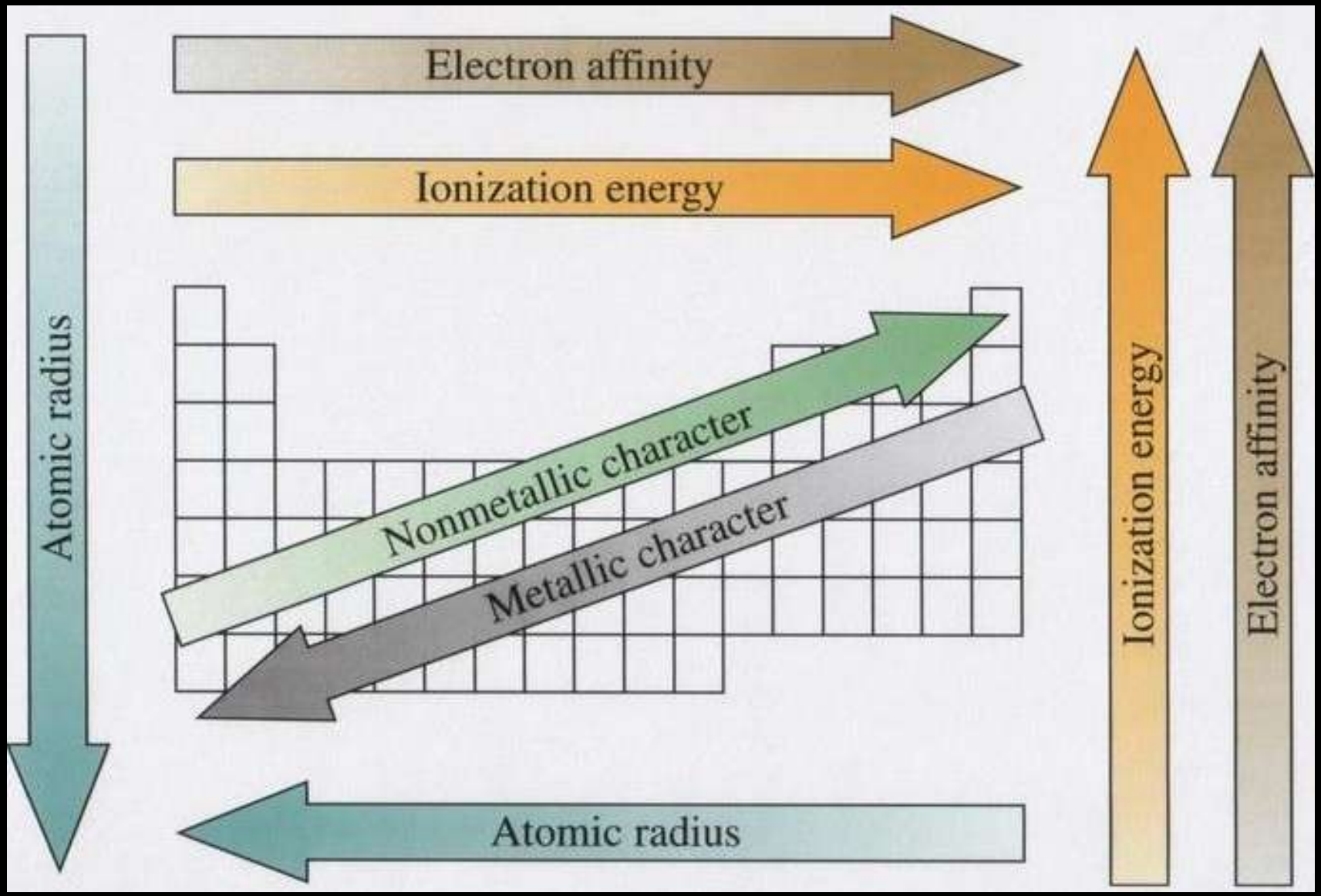
Anion?

Cation?

Objective:

You will UNDERSTAND how to write a basic chemical formula

Periodic Trends



Ions

Some compounds are composed of particles called "ions"

An **ion** is an atom (or group of atoms) that has a *positive or negative charge*

Atoms are neutral because the number of protons equals electrons

Positive and negative ions are formed when electrons are *transferred* (lost or gained) between atoms

Ionic Compounds

Ionic compounds contain ionic bonds

Formed when e^- are given/ taken between two atoms.

e^- are exchanged between atoms so that each atom will have a full outer shell (octet rule).

Ionic Compounds

When e^- are given/ taken, ions are formed, & the + ions attract the - ions.

Positive ion = Cation

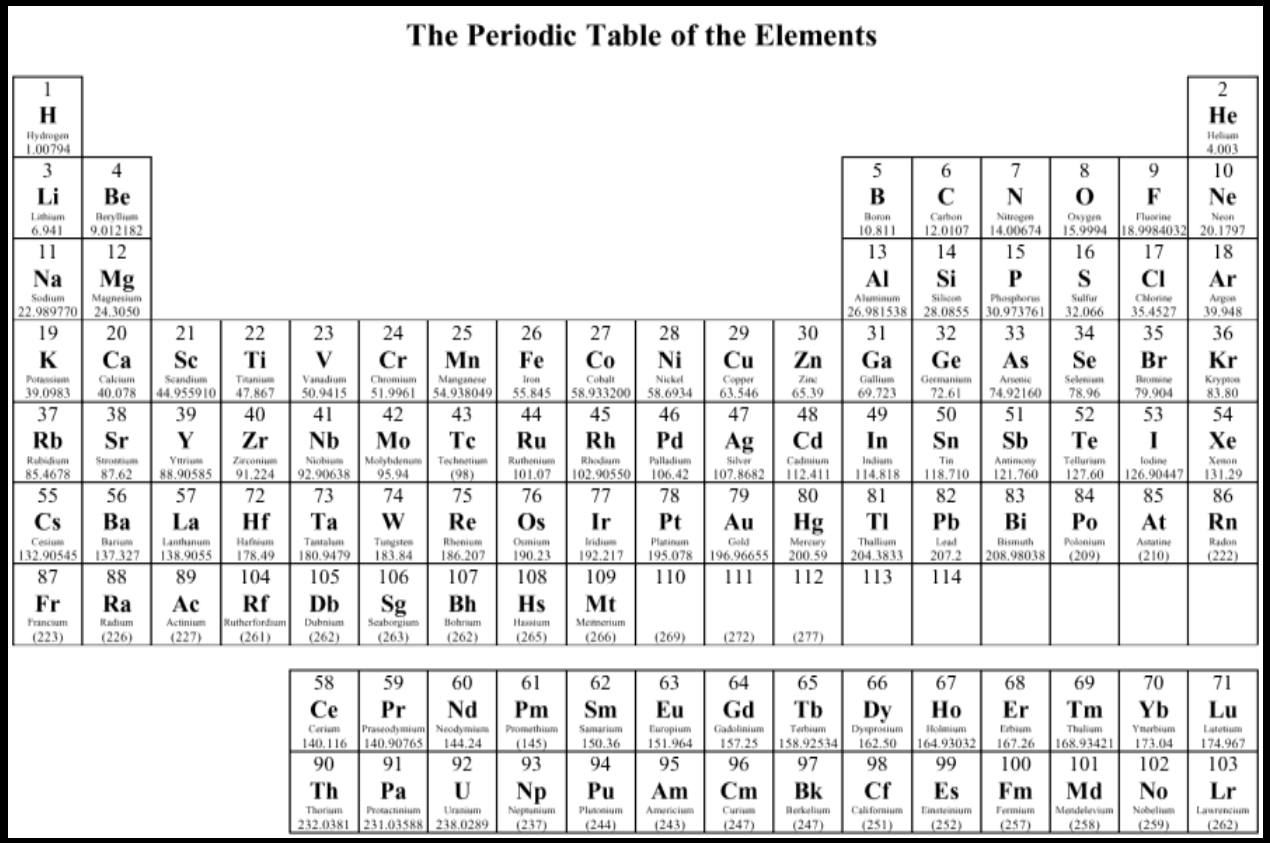
(Usually a metal, no change in name)

Negative ion= Anion

(Usually a nonmetal, usually ends in ide, ate, or ite)

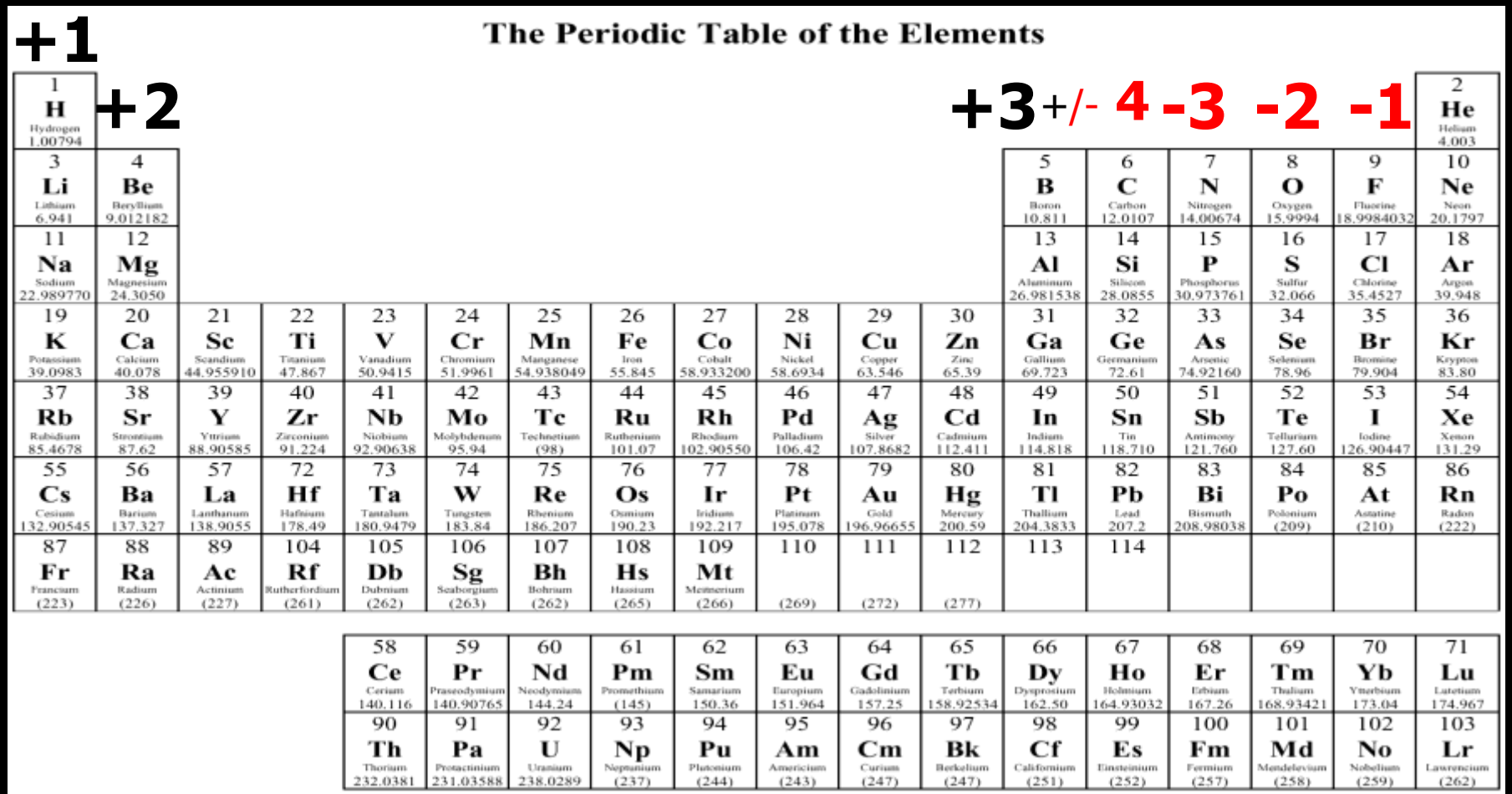
Ionization energy/ Electronegativity Trend

Increases →

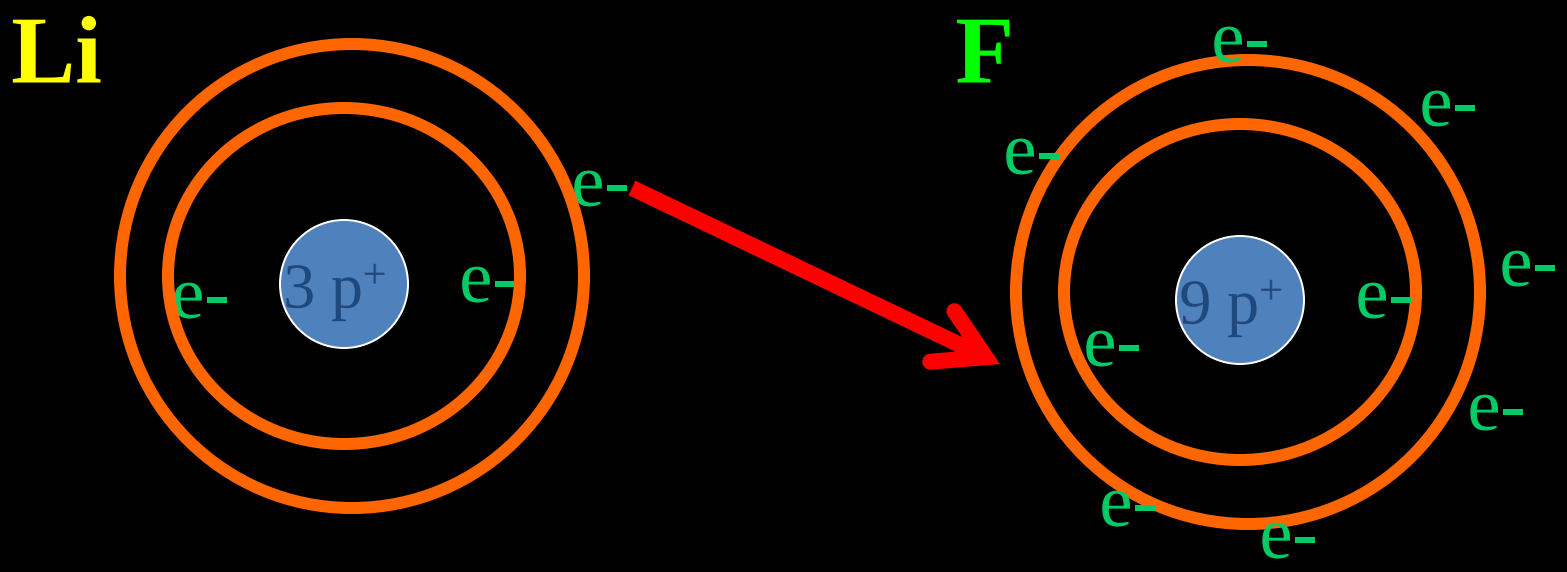


Increases ↑

Oxidation Number Trends



Example of how ionic bonds are formed…

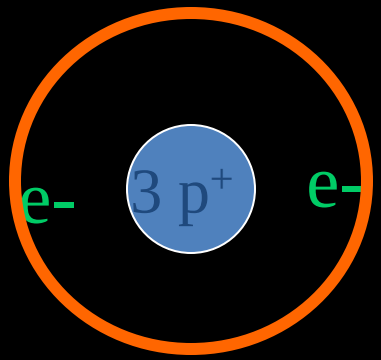


Wants to get rid of 1 e-

Wants to gain 1 e-

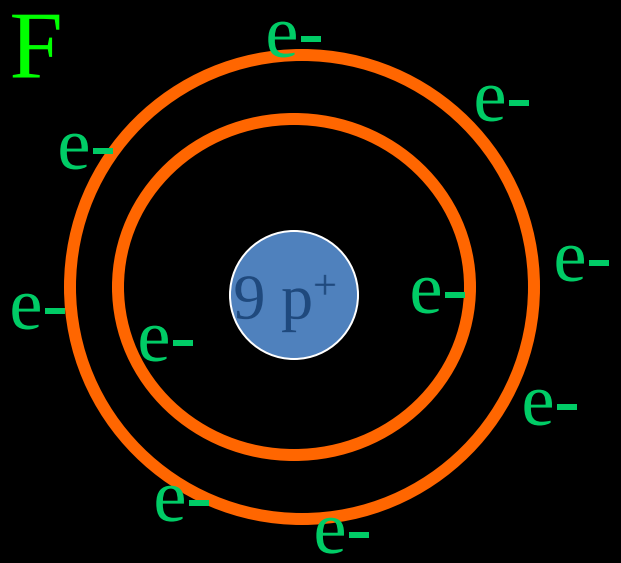
… since there is a mutual need to give and take one e-…

Li



Gives the 1 e- to F, to achieve a full outer level and…

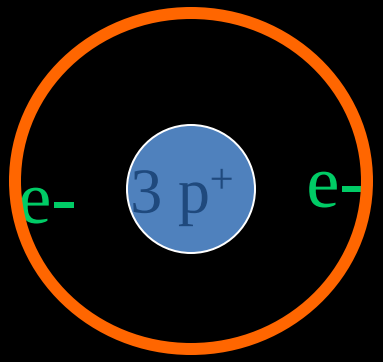
F



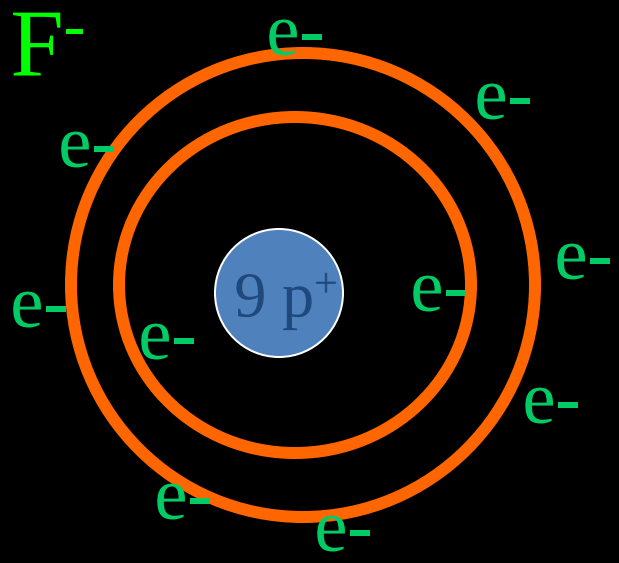
F gladly takes the 1 e- from Li to also achieve a full outer level.

Li and F have now become IONS!

Li^+



F^-



Li has 3 p+ and 2 e-

Now, Li has a charge of **+1**

F has 9 p+ and 10 e-

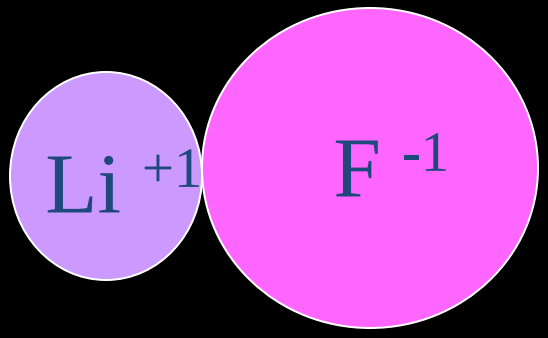
Now, F has a charge of **-1**

Remember the rules of attraction!

Since lithium is +1 and fluorine is –1, they are attracted to each other since…

OPPOSITES ATTRACT!

Now, together, they make…



or… LiF

Ion Prediction

Correctly write the ion, showing oxidation number.

Ion	Formula	Cation or Anion
Nitride		
Chloride		
Sodium		
Oxide		
Calcium		
Phosphide		

Warm up

What charge do ions in the alkaline earth metals always have?

What charge do group 5, 6, and 7 element generally have?

Ion Chip Practice

Use the ion "chips" to make each of the compound on the list. Then write the correct chemical formula.

Do not loose the ions chips and return to the bag when finished.

Ex.

Home Work 7-Nov

Read through Nomenclature tutorial rules and re work warm up in tutorial nomenclature

Objective:

You will complete a test on electron configuration and energy calcualtions

When finished

When you have finished your exam please get out you "Ion Chip Practice" that you started on the 7th and go into the lab to finish #11-30.

You may use your periodic table

Bell Work
25-Nov-2015

What is meant by the term "isotope’

What is an ion?

How many valence electrons does P have?

What is it’s common oxidation state (charge)?

Objective

You will know how to find oxidation number of any atom in a chemical formula

Classes of Chemicals

-Elements

-Ionic Compounds

-Molecular Compounds (also known as covalent compounds)

Elements

All elements on the periodic table

All just one word: iron, sodium, neon, etc.

All neutrally charged

Mostly monatomic: Fe, Na, Ne

Some **di**atomic: $\mathbf{H_2}$ $\mathbf{O_2}$ $\mathbf{N_2}$ $\mathbf{Cl_2}$ $\mathbf{Br_2}$ $\mathbf{I_2}$ $\mathbf{F_2}$

Gold

Ionic Compounds

Two Categories: binary ionic and ternary ionic

Binary Ionic Compounds

made of one metal - the positive ion (cation)
and one non-metal - the negative ion (anion)

Ternary Ionic Compounds

Made of one positive ion and one negative ion, but either both of the ions or only one of the ions is a **POLYATOMIC** ion

Writing formulas for binary ionic compounds

Ionic compounds are always ***neutral* (overall charge is ZERO)**

Since we depend on the ionic charges to determine our formula, the number of each ion within the compound is fixed (meaning, that the number of each ion does not ever change!)

Writing formulas for binary ionic compounds

- **Example: Sodium Oxide:**

Na^{+1} O^{-2}

When we add up our charges as shown, we get a net charge of –1.

Since the compound must be neutral we need another positive charge.

Now we have two sodium atoms to balance out the oxide so the final formula is:

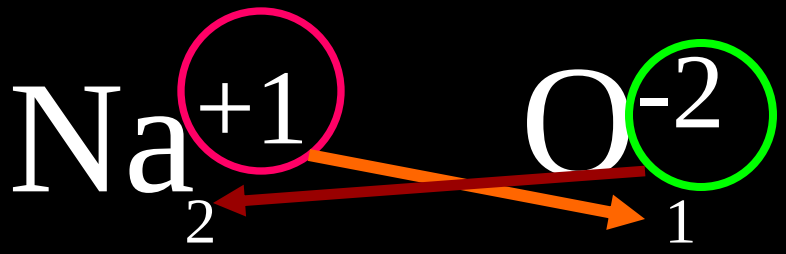
Na^{+1} So, we add another sodium ion to "even out" our charge.

Na_2O

But what's this criss-cross method they use in the book?

This method makes writing chemical formulas **sooooo** much easier!! Watch how easy it is…

Take the absolute value of the charge of the cation, and make it the subscript of the oxygen



Then do the same for the charge of the Oxygen – take the absolute value of the charge and make it the subscript for the sodium.

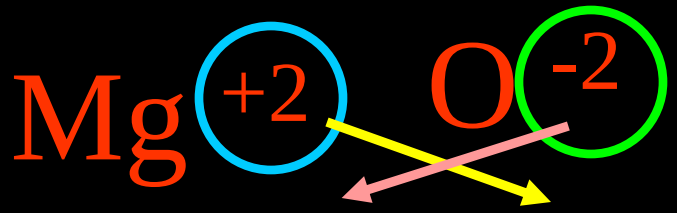
You then have…

Na_2O

Dangers of criss-cross method

This method may be easy, but you have to be careful…

Example:



Criss-cross the charges to get…

Mg_2O_2 Right???

WRONG!!

Subscripts must be reduced to the lowest multiple.

So, from our previous example…

Mg_2O_2 Must be reduced to…

MgO

Practice

Make them ions then combine ☺

K and Cl

Na and S

Ca and Cl

B and I

Be and As

Ca and P

Ca and N

Oxidation number

Oxidation number is the "charge" on an ion.

Not all of the ions in the representative elements follow their common oxidation states.

Ex. What would you expect carbon to be?

In carbon monoxide, CO, carbon is actually +2

Oxidation number

Some elements rarely deviate from the common charge:

F: -1

O: -2, unless a peroxide (O_2^{-2})

Alkali metals: +1

Alkaline metals:+2

Oxidation number

Generally the common oxidation states are correct but many times they are not. So we use basic algebra to determine the oxidation state:

CO: What is the charge of "C"

Remember the compound needs to be neutral, in other words the charges need to ad to zero.

1(x) +1(-2) = 0

CO

Or "x" is +2

Oxidation number

Use basic algebra to determine the oxidation state:

$Ca(NO_2)_2$: What is the charge of "N"

Remember the compound needs to be neutral, in other words the charges need to ad to zero.

1(+2) +2(x)+4(-2) = 0

$Ca(NO_2)_2$ **Or "x" is +3**

Ion Chip Practice

Write the chemical formula FIRST!

2nd Use the ion chips to make the compound

3rd Record how many of each ion are present.

Example:

Magnesium Chloride

Aluminum Sulfate

Closure

$CaSO_3$

What type of compound am I? (Covalent or Ionic)

What is my name?

If Calcium weighs 40amu, Sulfur weighs 32amu, and Oxygen weighs 16amu what would I weigh?

Before You Go

Think about the limitations of the Criss-Cross Method… are there any other ways to find the ionic formula?

Oxidation Number Practice

NO_2

Nitrogen ?

ClO^{-1}

Chlorine?

ClO_2^{-1}

Chlorine?

HCO_3^{-1}

Carbon?

HSO_3^{-1}

Sulfur?

Find The Oxidization State of Each Atom

1. PCl_5
2. Na_3PO_4
3. H_2SO_4
4. BF_3
5. $AlBr_3$
6. SF_8
7. NBr_4
8. Ba_2O

What is a polyatomic ion?

A polyatomic ion is a group of elements that travel together, and carry a charge

SO_4^{-2} = sulfate ion

CO_3^{-2} = carbonate ion

NO_2^{-1} = nitrite ion

NH_4^{+1} = ammonium ion

Using polyatomic ions in chemical formulas

- **Again - Ionic compounds are always *neutral* so the overall charge has to add up to zero**
- **Example: Lithium Nitrate:**

Li^{+1} NO_3^{-1}

When we add up our charges as shown, we get a net charge of 0.

So, our chemical formula is…

$LiNO_3$

What happens when you need more than one polyatomic ion?

Use parenthesis for multiple polyatomic ions

Aluminum chromate

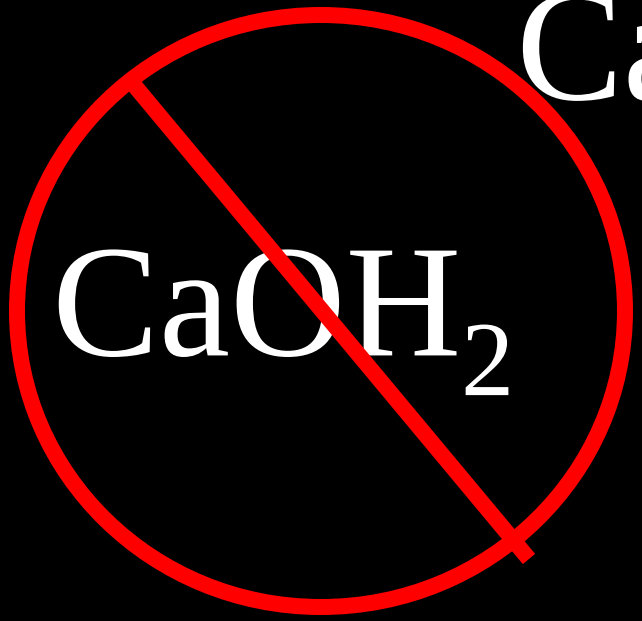
$Al^{+3}\ CrO_4^{-2}$

$Al_2(CrO_4)_3$

Be careful of Hydroxides!

Calcium hydroxide

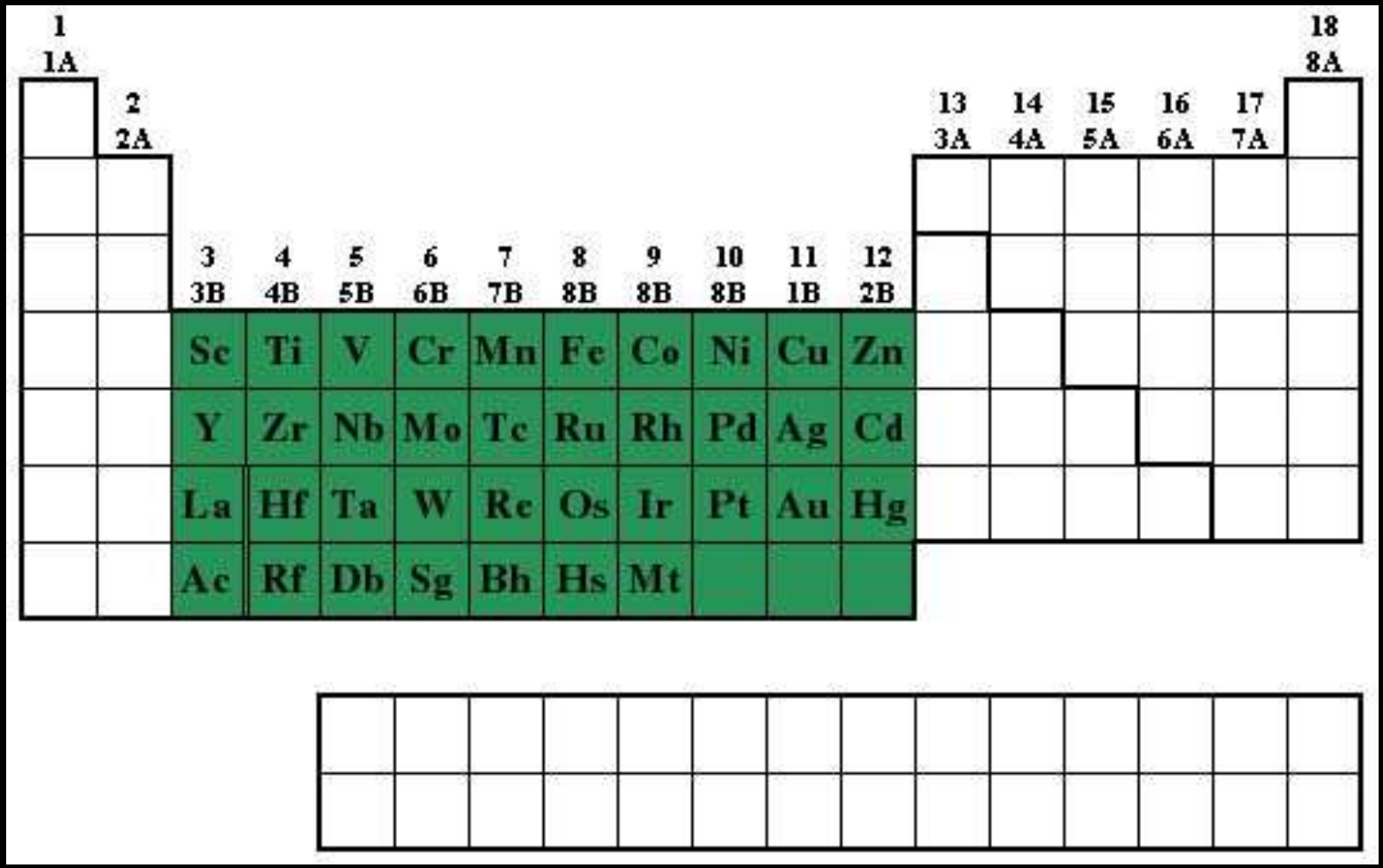
$Ca^{+2}\ OH^{-1}$



$CaOH_2$

$Ca(OH)_2$

What about… Transition Metals???



Transition Metals

Transition Metals often have more than one charge

Examples: Fe^{+2} and Fe^{+3}

This makes a difference in formula:

Iron chloride could be:

$FeCl_2$ or $FeCl_3$

So what do we do? (don't give up yet!)

Since $FeCl_2$ and $FeCl_3$ are obviously not the same compound, they can't both have the same name.

We differentiate them by using a Roman Numeral to indicate the charge on the transition metal

Fe^{+2} and Cl^{-1} → $FeCl_2$ = iron (II) chloride

Fe^{+3} and Cl^{-1} → $FeCl_3$ = iron (III) chloride

Be sure to note that the roman numeral indicates *charge* and not *number*.

What about transition metals?

Remember – transition metals have varying charges.
Ex: Iron (Fe) exists in a +2 and a +3 state.

So, to writing formulas, the charge of a transition metal must be given to you in some form.

Most common form is a Roman numeral in parentheses after the element name.

Ex: nickel (II) nitrate: $Ni(NO_3)_2$

Here, Ni has a +2 charge, as indicated by its Roman Numeral.

Homework
14-nov-2014

Chapter 7 #10, 11, 12, 17, 18, 26, and 28

Warm up

Write these formulas…

Potassium hydroxide

Silicon dioxide

Aluminum Sulfate

Barium Phosphate

Hydrogen ferrocyanide

Calcium acetate

Ionic Compounds

Two Categories: binary ionic and ternary ionic

Binary Ionic Compounds

- **made of one metal positive ion (cation) and one non-metal negative ion (anion)**
- **Always two words starting with the cation and ending with the anion**
- **Cation is same name as element**
- **Anion always has a different suffix**
- **Drop ending and add "ide"**

Sodium chloride

Anion Suffixes in Binary Ionic Compounds

Anions end with *–ide*

Oxygen ion = O^{-2} = Ox*ide*

Sulfur ion = S^{-2} = Sulf*ide*

Chlorine ion = Cl^{-1} = Chlor*ide*

Bromine ion = Br^{-2} = Brom*ide*

Phosphorus ion = P^{-3} = Phosph*ide*

Let's try some examples!

$CaCl_2$ Calcium Chloride

SrO Strontium Oxide

NaI Sodium Iodide

Li_2S Lithium Sulfide

Next stop: Ternary Ionic Compounds

Since the polyatomic ion already has its own name, we do not have to change anything! So… no changing suffixes, etc.

Let's practice!

$Mg(NO_3)_2$ *Cations are positive*

- **Remember – the first name does not change**
- **Then just add on the name of the polyatomic ion**
- **So…$Mg(NO_3)_2$ is named Magnesium Nitrate.**

Quick practice

NaBr	Sodium bromide
CaO	Calcium oxide
$Al(NO_3)_3$	Aluminum nitrate
$(NH_4)_3PO_4$	Ammonium phosphate
$Ba(OH)_2$	Barium hydroxide
Cu_2S	Copper (I) sulfide
$CuSO_4$	Copper (II) sulfate
$Fe_2(Cr_2O_7)_3$	Iron (III) dichromate

More practice

Potassium hypochlorite	KClO
Sodium sulfite	Na_2SO_3
Aluminum bromate	$Al(BrO_3)_3$
Ammonium phosphate	$(NH_4)_3PO_4$
Magnesium nitrite	$Mg(NO_2)_2$
Iron (III) perchlorate	$Fe(ClO_4)_3$
Strontium nitrate	$Sr(NO_3)_2$
Copper (I) sulfate	Cu_2SO_4

Bell Work
30-Nov-2015

What is an ionic compound?

What type of bonds do they have?

What is the correct name for $Mo_2(SO_4)_3$?

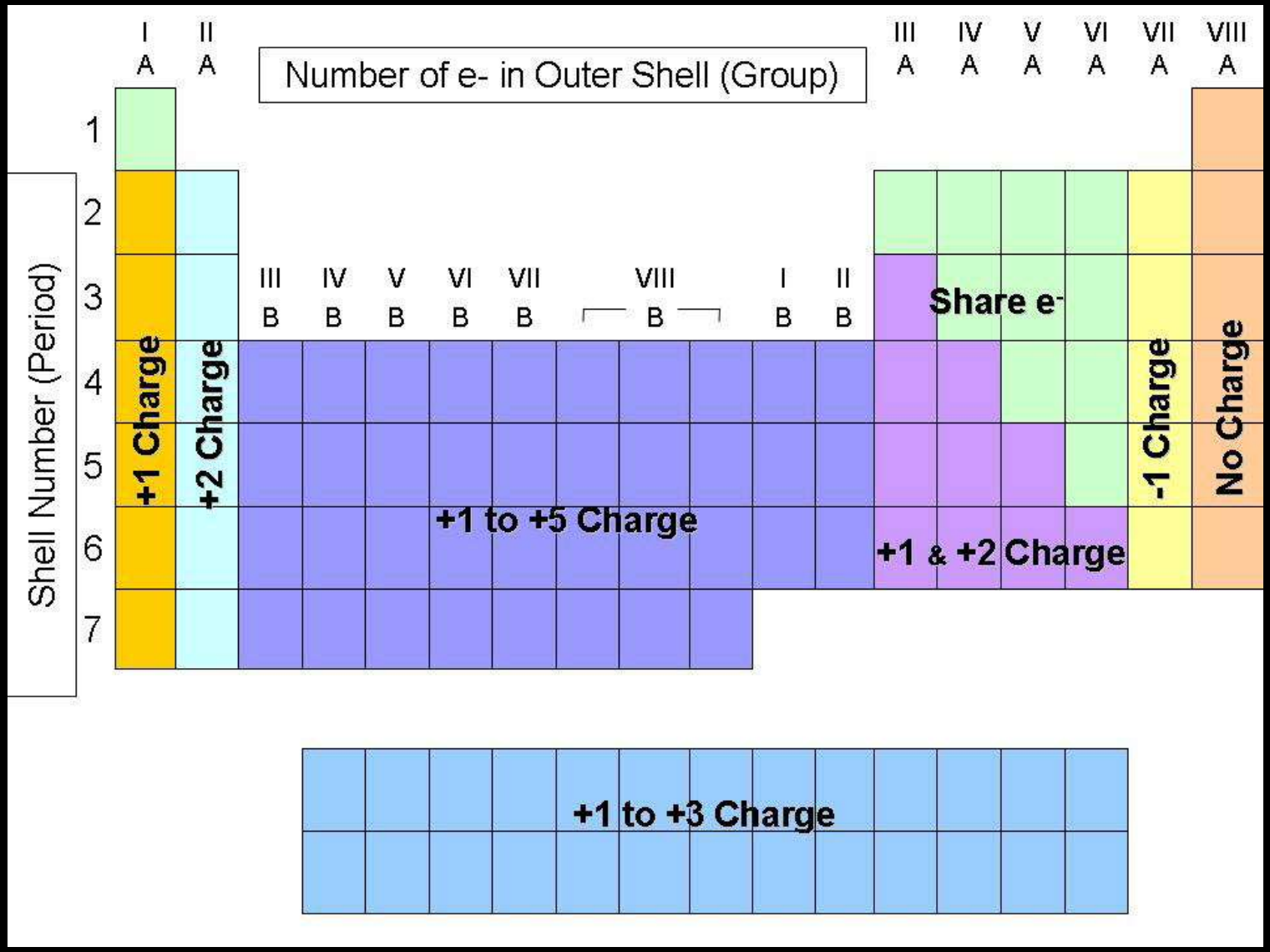
EQ: How does chemical naming exhibit organizational patterns?

Objective

You will know how to write a covalent compound name from it's formula

You will know the difference between ionic and covalent compounds

Oxidation Number Review



Molecular (or covalent) Compounds

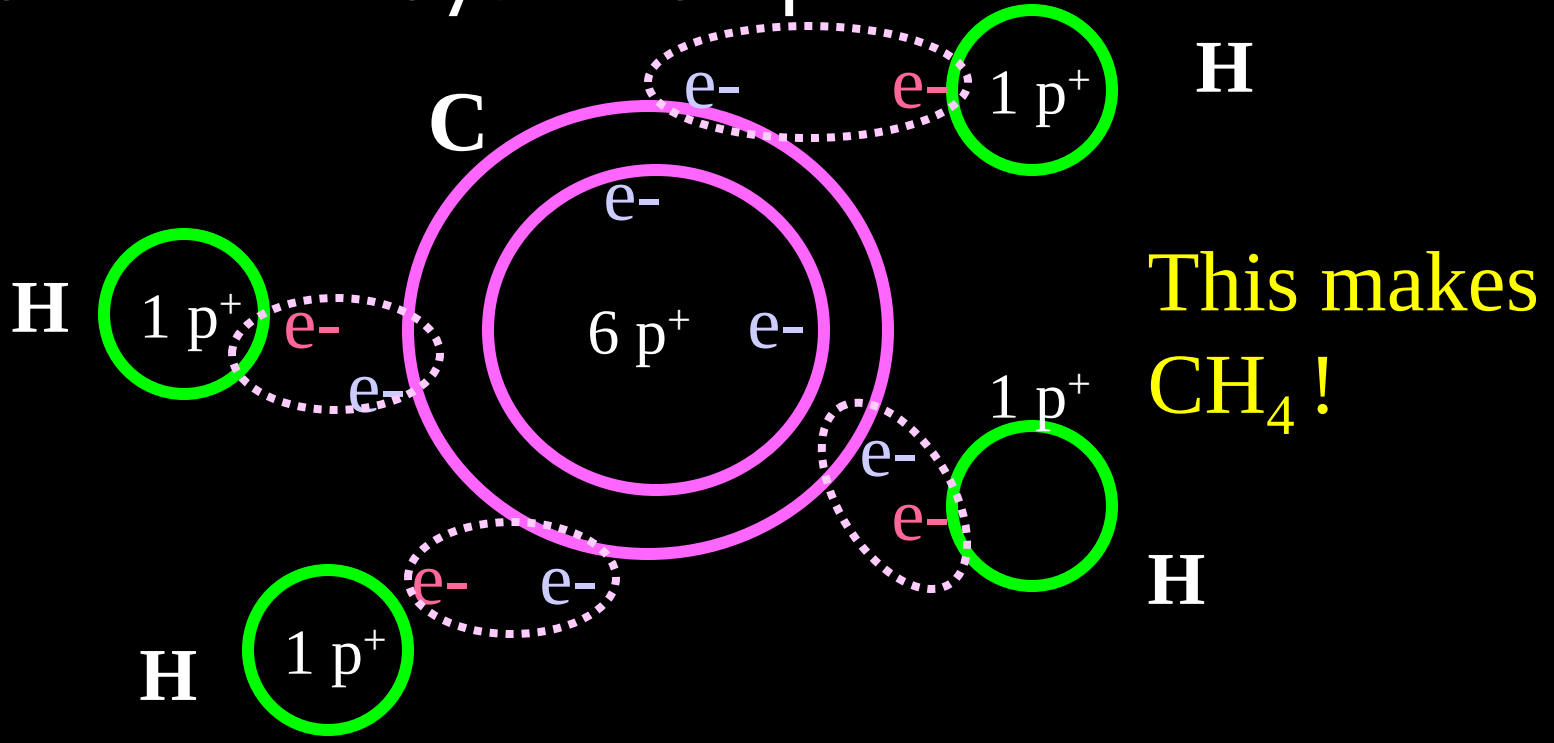
Comprised of two or more non-metals covalently bonded (electrons are shared!)

Do not combine in set ratios like ionic compounds.

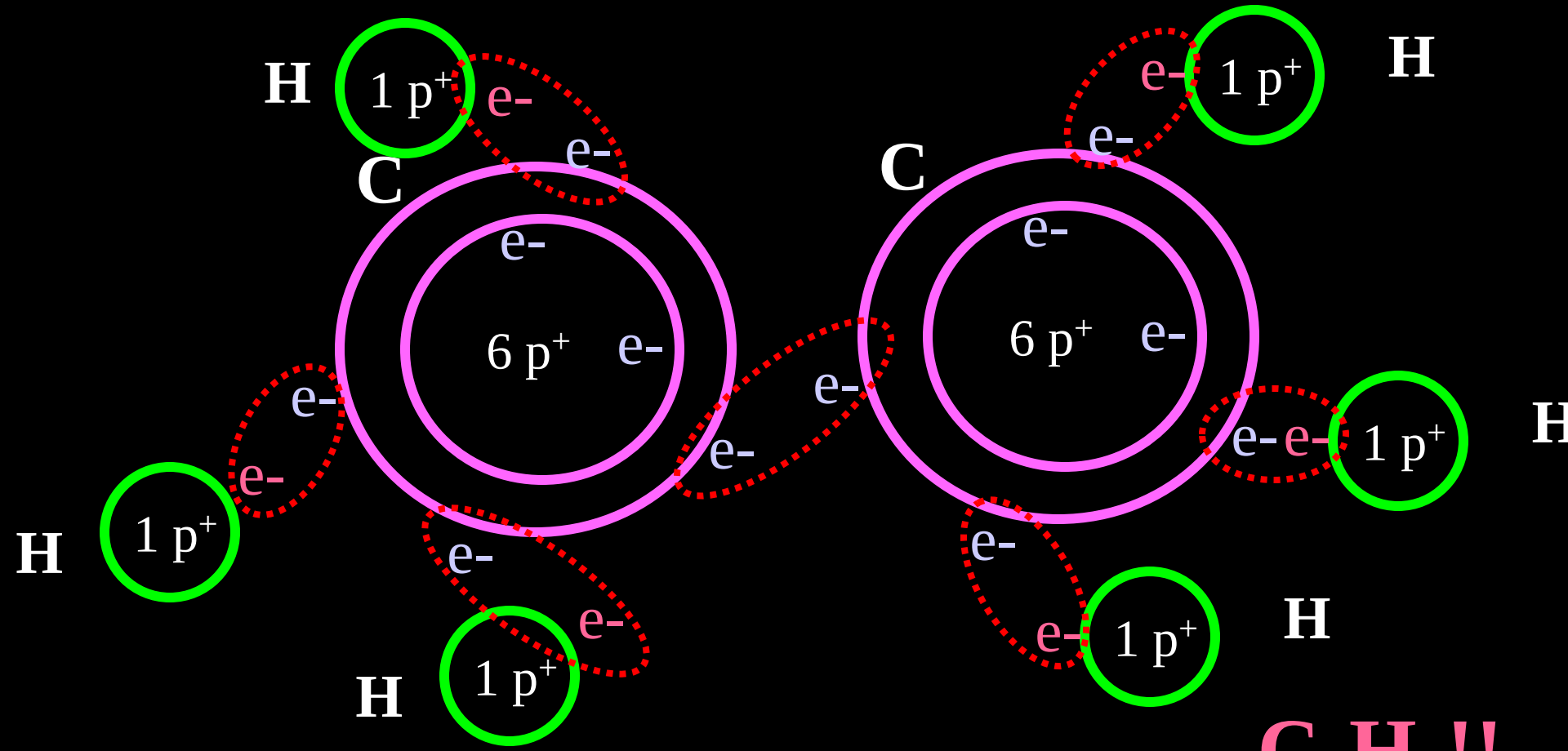
Do not conduct electricity.

Due to covalent bonds…

The same elements can combine together in different ways. Example…



But carbon and hydrogen can also combine to form other compounds, such as…



C_2H_6!!

Naming Molecular/Covalent Compounds

Name as normal except that **all** compounds change the second element to an –**ide** ending

CO = carbon ox*ide*

CS_2 = carbon sulf*ide*

NF_3 = nitrogen fluor*ide*

*Notice: the atom that is more towards the right (**more electronegative**) onthe periodic table is listed second & ends in **-ide***

Problem

Covalent compounds can combine in multiple proportions due to the ability to share electrons and also to form double and triple bonds … there can be more than one ratio of atoms in a compound

CO **vs.** **CO_2**

They can't both be carbon oxide!

NO_2 **vs.** **N_2O_4**

They can't both be nitrogen oxide!

Solution?

Use prefixes to indicate the number of covalently bonded atoms present in the molecule

CO **vs.** **CO_2**

Carbon ***mon***oxide Carbon ***di***oxide

Prefixes

1 Mono-
2 **Di-**
3 **Tri-**
4 **Tetra-**
5 **Penta-**
6 **Hexa-**
7 **Hepta-**
8 **Octa-**
9 **Nona-**
10 **Deca-**

Overall Covalent Rules

- Comprised of two or more **non-metals** covalently bonded
- List the element that is ***less electronegative first***, then list the element that is more negative.
- Name as normal except that all compounds change the **second element** to an **–ide** ending
- Add a **prefix** to indicate # of atoms in the compound
- The second atom **ALWAYS** gets a prefix
- The first atom can **ignore** MONO-

Practice

CO	Carbon monoxide
N_2O_5	Dinitrogen pentoxide
PCl_5	Phosphorus pentachloride
SO_3	Sulfur trioxide
N_2O	Dinitrogen monoxide

Nomenclature packet

Finish the Chemical Nomenclature packet, when you are done check your neighbors answers. We will turn this in Thursday 3 Dec. 2015.

Practice Makes Perfect

1) As_4O_{10}
2) BrO_3
3) BN
4) N_2O_3
5) NI_3
6) SF_6
7) XeF_4
8) PCl_3
9) CO
10) PCl_5
11) P_2O_5
12) S_2Cl_2
13) ICl_2
14) SO_2
15) P_4O_{10}
16) UF_6
17) OF_2
18) ClO_2
19) SiO_2
20) BF_3
21) N_2S_5
22) CO_2
23) SO_3
24) XeF_6
25) KrF_2
26) $BrCl_5$
27) SCl_4
28) PF_3
29) XeO_3
30) OsO_4

Bell Work
1-Dec-2015

PO_3

What type of compound am I?

What is my name?

If Phosphorous weighs 31amu and Oxygen weighs 16amu what would I weigh?

Objective:

You will see the differences in ionic an covalent compounds

Due 3.Dec.2015:

Nomenclature Tutorial (All of it #1-75)

Properties of Ionic and Covalent Substances Lab

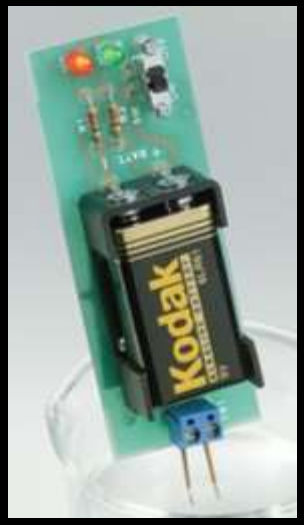
Go through an record the definitions/ background on ionic, covalent, and each of the three (3) parts of the lab.

Properties of Ionic and Covalent Substances Lab

Follow all instructions.

Fold foil in boat

Dispose of Al foil boat in solid waste contained in middle of lab.



Wipe leads off of conductivity tester.